Process Skills: Definitions and Examples

The science process skills are the tools that students use to investigate the world around them and to construct science concepts, so it's essential for teachers to have a good understanding of these skills. However, identifying and defining the process skills is not always a simple task.

The first problem is that the skills aren't practiced discretely. When you look at a real-life situation, you're likely to find several related skills being used more or less at the same time. Consider, for example, trying to explain why water drops appear on the outside of a can filled with ice: You're observing the phenomenon, you're interpreting what your observation means, and you're proposing a hypothesis, or explanation. It can be challenging to tease out separate skills because to a certain extent the boundaries are artificial. But it's necessary to be able to distinguish individual skills in order to work effectively with students.

The second problem concerns how broadly or narrowly the skills should be defined. The skill of classifying, for example, while often found listed as a separate skill, can also be viewed as a subskill of observing. Because it can be quite cumbersome to work with a long list of narrowly defined skills, this document presents seven broadly defined skills and indicates subskills where appropriate.

The definitions and examples given below are based on a number of sources and represent commonly accepted uses of the process skill terms.

Observing

Using the senses and appropriate tools to gather information about an object, event, or phenomenon.

SUBSKILLS include collecting evidence, identifying similarities and differences, classifying, measuring, and identifying relevant observations.

EXAMPLE: Listing the similarities and differences of a cube of ice and a ball of ice.

Questioning

Raising questions about an object, event, or phenomenon.

SUBSKILLS include recognizing and asking investigable questions; suggesting how answers to questions can be found; and turning a noninvestigable question into a question that can be acted upon.

EXAMPLE: Asking "Will ice melt faster with or without salt sprinkled on it?"

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Hypothesizing

Giving a tentative explanation, based on experience, of a phenomenon, event, or the nature of an object. A hypothesis is testable. A hypothesis is *not* the same thing as a prediction, which is the expected outcome of a specific event. However, a hypothesis can be used to explain specific events.

SUBSKILLS include inferring, constructing models to help clarify ideas, and explaining the evidence behind a hypothesis.

EXAMPLE: Increased surface area causes faster melting. (This explains why crushed ice will melt faster than a block of ice of the same mass.)

Predicting

Forecasting the outcome of a specific future event based on a pattern of evidence or a hypothesis (an explanation). A prediction based on a hypothesis can be used in planning a test of that hypothesis. NOTE: A prediction is *not* a wild guess.

SUBSKILLS include justifying a prediction in terms of a pattern in the evidence, and making a prediction to test a hypothesis.

EXAMPLE: Water flowing from a height of eight inches will wash away more sand than water flowing from a height of six inches; this prediction is based on the pattern that water flowing from six inches washed away more sand than water flowing from four inches, and water flowing from four inches washed away more sand than water flowing from two inches.

Planning and Investigating

Designing an investigation that includes procedures to collect reliable data. Planning includes devising a way to test a hypothesis. NOTE: Planning is not always formal.

SUBSKILLS include identifying and controlling variables, and using measuring instruments.

EXAMPLE: Deciding to put a teaspoon of salt on one ice cube and a teaspoon of sugar on another identical ice cube; setting them side by side, and observing their relative melting rates in order to determine if one melts faster than the other.

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Interpreting

Considering evidence, evaluating, and drawing a conclusion by assessing the data: In other words, answering the question, "What do your findings tell you?" Finding a pattern or other meaning in a collection of data.

SUBSKILLS include interpreting data statistically, identifying human mistakes and experimental errors, evaluating a hypothesis based on the data, and recommending further testing where necessary.

EXAMPLE: After observing the melting rates of an ice cube sprinkled with salt and one without salt, concluding that salt reduces the freezing point of water.

Communicating

Representing observations, ideas, theoretical models, or conclusions by talking, writing, drawing, making physical models, and so forth.

SUBSKILLS include talking with a more knowledgeable person, using secondary sources, presenting reports, constructing data tables, and creating charts and graphs.

EXAMPLE: Describing the relationship between the melting time for an ice cube and amount of salt sprinkled on the cube by writing about it or by constructing a graph.

NOTE: These definitions are adapted from the following sources:

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